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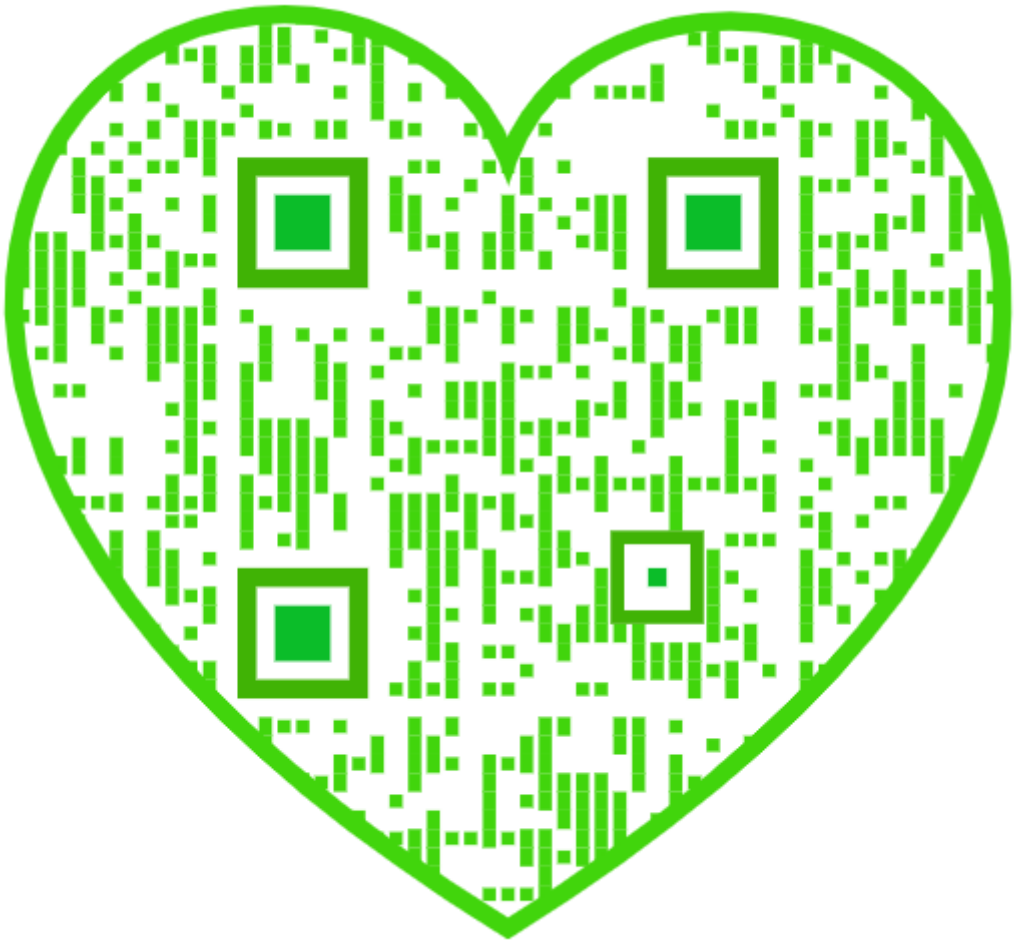

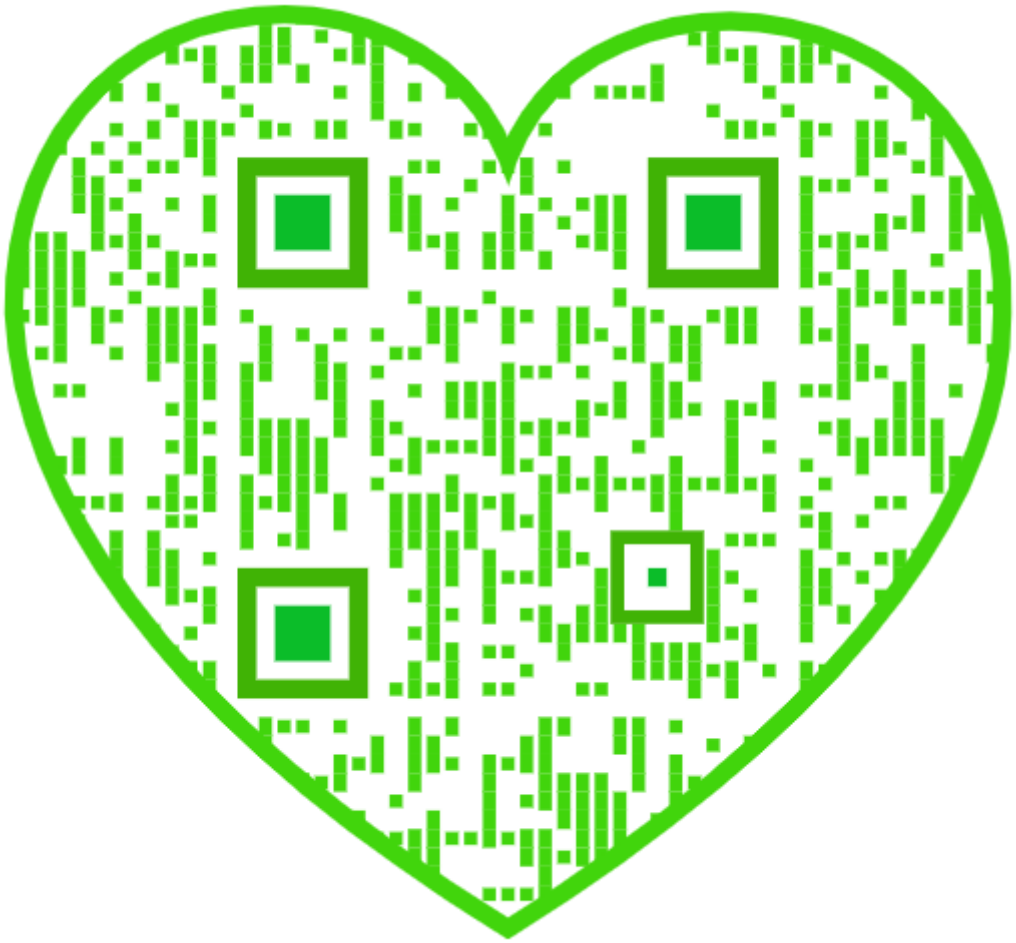

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UNITED STATES OF AMERICA.

THE WATCH;

ITS CONSTRUCTION, ITS MERITS AND DEFECTS,

HOW TO CHOOSE IT,

—AND—

HOW TO USE IT.

ILLUSTRATED WITH ENGRAVINGS.

BY H. F. PIAGET,

A Watchmaker of forty years practical experience.

TO WHICH IS ADDED,

A SHORT ESSAY ON CLOCKS,

AND HOW TO USE THEM.

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DEDICATION.

TO MY MOST ESTEEMED FRIEND,

MR. FERDINAND THIERIOT,

THIS ESSAY

IS MOST RESPECTFULLY DEDICATED BY THE AUTHOR,

HENRY F. PIAGET,

John Street, New York.

PREFACE.

No one doubts that it requires a certain skill to make or mend a watch, yet many doubt that it requires certain knowledge to choose one, and when chosen, certain care to use it.

Care will go a long way, but not all the way; to care must be added some knowledge to give the right direction to its exercise.

My lengthened experience has taught me that numbers of valuable watches are often ruined by the want of care or skill in their use, and then the blame is laid at the door of the watchmaker.

A man buys an expensive watch, and naturally expects it to perform well; he misuses it, and it either stops altogether, or performs badly; he exclaims, "I have been duped in buying that watch." He takes it to a third party to set it to rights; that done, he again misuses it, or some unavoidable disarrangement happens to it, he then declaims against all watches and watchmakers.

Thus a watch which should be an article of use and ornament to its owner, is too often only a source of vexation and expence.

Now I propose partly to remedy this, not by attempting to make every one his own watchmaker, but by imparting, in a familiar manner, such practical hints of the construction, and the use of a watch, as will enable them to use it properly, and guard against some of the annoyances and expenses, which without such information they are liable to incur, as well as prevent the watchmaker or repairer being frequently erroneously blamed.

The inexperienced in the trade will also find many suggestions which may be useful to them, for they must know that a good watchmaker is not always a good repairer; for owing to the variety of different kinds of watches that pass through his hands, practice must be added to knowledge and skill, to properly repair a watch. My life having been devoted to my profession, I have had neither the time nor opportunity to cultivate the graces of phraseology. The following is my first essay at authorship, and I ask for it the indulgence as to its literary merits, always so benignly extended to maiden efforts. I have endeavored to put down what I had to say plainly and intelligibly, striving rather to state useful facts, in a manner to make myself clearly understood, than to manufacture a mass of nicely worded sentences, signifying nothing; for be it known "I am a plain blunt man, who only speak right on, and tell but that which I myself do know."

REMARKS ON TIMEKEEPERS.

—o—

Toward the middle of the sixteenth century springs were applied instead of weights as the maintaining power to timepieces, thus enabling them to be made small and portable; but these pieces, now called watches, were imperfect machines, going with even less precision than an old clock; they had only an hour hand, and most of them required winding twice a-day. Scarcely more than a century has elapsed since watches were nearly completed, with the exception of the external parts, by individual labor alone.

The art of watch making is now divided into more than thirty or forty different branches, according to the different kind of watch made. By machinery and a division of labor, watches are now made at a much lower price than formerly; but for their greater perfection we are indebted to improved principles. The English were the first successful manufacturers of watches; all the escapements applied to good ones, whether at home or abroad, were invented by them. It is true that many ingenious contrivances have been

introduced at different times by French and Swiss artists, but they themselves have ceased to apply them; and with the exception of the vertical (the inventor of which is unknown), they generally adopt those principles only, which were first devised by English watchmakers. The horizontal, or cylinder escapement, by Graham, the lever escapement by Mudge, the duplex, invented by Dr. Hook and perfected by Tyrer, while the detached or chronometer escapement, although, invented by Berthoud, is indebted for its accuracy to the improvements by Arnold, Earnshaw and Dent.

The discovery of the art of piercing holes in rubies for pivot-holes to watches, is attributed to M. Fazio, a native of Geneva, who having failed in his attempt to get his plan adopted in Paris, went to London in 1700, where the art of watchmaking was rapidly advancing. He was well received, and his plan being very generally adopted, added greatly to the reputation of English watches. The rubies are still used in good watches; they are the hardest stones that can be drilled; but at the present time cheap watches are jewelled with all kinds of stones, as chrystals, garnets, &c., they being cheaper: English and American watches have however usually the jewel over the upper part of the balance made of diamond, it does not require to have a hole through it, the pivot resting on the end instead of a shoulder, as in the wheels, on account of the extreme freedom required. The English, being a maratime nation, their attention was early directed to the improvement of marine chronometers, and their researches enabled them to give an accuracy to pocket watches, which rendered them preferable to all others. The

French have never been able to establish a large or permanent manufacture of watches, although from the exertion of several eminent men, as Le Roy, Breguet, and Lepine, they have produced them of a very superior class. They were the first to reduce the size of the old watch, and from the high price not unfrequently given, they could afford to bestow much care and time upon the construction, so as to produce astonishing precision in the small watches. The Swiss have become the largest manufacturers of watches in the world; this arises partly from the absence of other branches of industry, but principally from the low price of labor, and also from the number of females and children who work at the business, (the writer commenced when only seven years old,) enabling them to be produced at so low a rate as to have entirely superceded the French watch. The cheap and showy watches which inundate the windows of jewelers, dealers in trinkets, &c., in every country, as well as those advertised as so cheap, are principally of Swiss manufacture ; but if English, they are generally of an inferior quality.

In the reign of William III, of England, it was considered necessary to pass an act obliging watch makers to put their names upon all their watches, to prevent the discredit to which the manufacture was exposed from the bad watches sold abroad as English.

Different governments have endeavoured to enforce protecting duties. Twenty years ago, all foreign watches imported into France for the purpose of sale, had to be stamped, to show that they were not of French make, and that the duty had been paid ;—this stamp (a bull's head) could be seen on nearly all

watches sold in Paris at this time. It was generally put upon the pendant, but occasionally on other parts of the case. In England there was a duty of twenty-five per cent. on the importation of foreign watches for sale. Those for private use were admitted on a fine of five shillings each; and a recent law enacts that they shall have the maker's name and place of abode engraved upon the movements.

There is, however, no stamp, as there is in France, and smuggling is carried on to such an extent as to render the duty ineffective as a protection to trade, and of little value to the revenue; while in many instances, where the duty has been paid, fresh names are engraved upon them, and they are sold as having been made in England. For the protection of the American manufacture of watches, some plan should be adopted to be enabled to distinguish the genuine from the false, for the American watch is at the present time imitated abroad, and many persons may yet be deceived when they think they are encouraging home manufacture, are wearing watches (the case perhaps excepted,) of foreign make.

Watches and movements are imported in this country, particularly the cheap kinds, which have the name of some celebrated maker engraved on; others, with the names of makers long extinct, or of some which never existed. This can only be prevented by applying to an honest and upright watchmaker or dealer, who will not deceive you, if he values his reputation.

More rapid production and better workmanship in the detached pieces or parts, are the natural results of a well matured system of division of labor; but sub-

division for cheapness alone, is destructive to the unity necessary to produce a good watch; hence while lowness of price is a point of competition, (and to meet the demands of society it always will be,) the greater number of watches must be of an inferior kind.

The great difficulty of establishing this manufacture, even under the most favorable circumstances, has been amply shown by the failure of those in France; while those in Germany have been equally unsuccessful.

There are manufactories of watches in this country which make a very good time-keeper, and are continually improving; but a great help to them would be a heavier duty on foreign watches and movements. This I hope will be done, and that the American watch will be successful. The English and Swiss are now the sole exporters of watches, and they may be said to supply the world. Swiss watches are handsome—their size also in perfect accordance with the present taste—and did the production of the two countries differ in price only, this manufacture would be lost to England as it has been to France.

THE CONSTRUCTION OF WATCHES.

A clock has a combination of wheels to mark the number of oscillations made by a pendulum. A watch is a similar combination to mark the number of vibrations made by a balance. The wheels of a clock may be impelled by a weight, and the time measured by a pendulum; but as the watch must go in all positions, neither the weight nor the pendulum can be applied to it.

The power of motion in a watch is produced by means of a spiral spring, usually called the main spring, placed in a drum or barrel, which when wound round a centre will from its elasticity cause the barrel to make as many revolutions as there are turns made by the spring. Time is measured in a watch by the vibrations of a balance, which if moving in equal space, will make all the vibrations in equal time.

Main Spring.

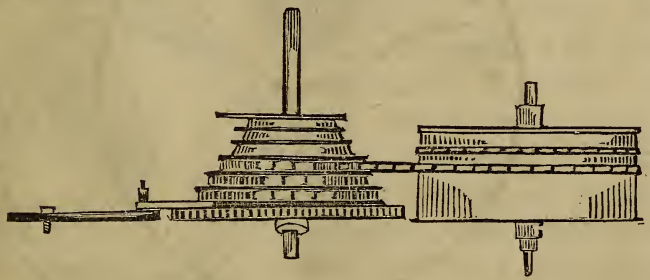
The escapement is the name given to that part of the watch which transmits the power from the wheels to keep up the vibrations of the balance; the escapement also prevents acceleration of the wheels, by holding them in check until the balance has completed its vibration. If the force exerted by the unfolding of the spring be equally transferred through the wheels to the escapement, and if the impulse given by the escape ment to keep up the vibration of the balance be equal, then will the motion of the balance be also regular, and the watch will measure equal time. But the force of the spring is unequal—it is strongest when fully wound, and becomes weaker as it uncoils. To compensate this inequality, a cone is employed with a spiral groove, called a Fuzee, to which is attached the first wheel.

The wheels of a watch are thus called:—The wheel on the fuzee is the first wheel; the centre wheel, the pinion of which carries the minute hand; the second, or centre, the one which in ordinary watches carries the second hand; the fourth, and the next, the escape wheel. In the old rack-lever watches there is one

wheel less, the second hand being carried on the pinion of the escape wheel; the second hand then went very fast round, but these kind of watches are nearly out of use, many of them having been altered to the present lever escapement.

The going fuzee, invented by Harrison, to make a watch continue to go while being wound up, and used in all good English watches, has an auxiliary spring, through which the force of the main spring is carried to the wheels. While the watch is being wound, a ratchet and click prevent the reaction of the auxiliary spring which therefore continues to act during the time of winding, although the power

Auxiliary Spring.



Maintaining Power, Click, and Spring.

Barrel. Fuzee, and Chain.

of the main spring is then taken off. The fuzee is connected with the barrel containing the spring, by a chain, with hooks at each end. In winding the watch, the chain is wound off the barrel and around the fuzee. When the watch is fully wound, the spring is at its greatest power, but the chain being then around the smallest part of the cone of the fuzee, the influence of the spring is at the smallest.

As the watch goes down, the power of the spring relaxes, but as the cone enlarges, its influence increases, and when the spring is down, the chain is upon the base of the cone, where the influence of the spring is the greatest. Upon the shape of the cone of the fuzee, therefore, depends the quality of the maintaining power. There is usually about half a turn of the weakest part of the spring left without action, to enable it to draw all the chain to the end, otherwise the watch would not run quite down ; that is regulated by a click and ratchet upon the barrel arbor.

Ratchet and Click.

In some watches the ratchet and click are placed under the dial, and cannot be seen by the wearer ; in others they are placed on the bar that holds the barrel, and are easily seen on opening the watch.

The fuzee, or cone, can not be introduced into very flat watches. The barrel therefore, instead of the fuzee, is attached to the first wheel, by the barrel

having teeth cut at the sides, and is called the going barrel.

Going Barrel,

English Stop Work.

Stop works are necessary to every watch, particularly to those with chains, as to those without, the chain would be almost sure to break, particularly in thick English watches. In Swiss watches, and in all with going barrels, or without a chain, they are indispensable, (to a good watch) as by them the spring is regulated as near as possible in its action; not to be too strong when fully wound, nor too weak when nearly run down. A watch without stop works, "or one with imperfect ones," will be in danger of having the spring or some of the teeth of the barrel broken in winding.

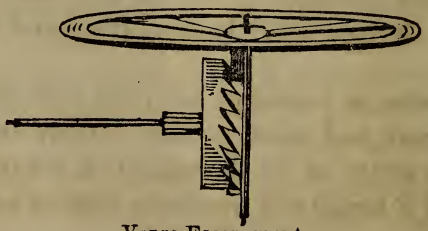
Swiss Stop Work.

If the spring is wound up too tight it is much more liable to break, and when broken, if there are no stop works, the strain of the key comes on the teeth of the barrel, and if forced will frequently bend or break them.

If the spring to a going barrel be well made, and the wheels so constructed that only the middle turns of the spring are required to be in action, and not those turns of the spring in which it is at its greatest or least power, the force may be sufficiently equal for ordinary purposes; but where the fuzee can be applied it is preferable and certainly the best.

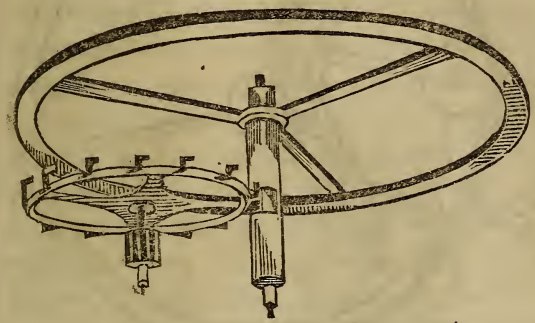
The power of the spring is conveyed to the escapement through the wheels, and the arrangement is nearly the same in all watches, therefore their comparative value in this part of the construction depends entirely upon the skill of the workman and the quality of the materials. The power of the spring being equal, and the wheels and pinions properly constructed and placed correctly to act with each other, which is called "pitching the depths." (This is a term used in wheel work, and it is necessary that the wheels and pinions be placed at proper distances from each other, or there is friction, cutting and noise in the action, which should not be in a good watch.) to convey the power to the escapement, and to keep up the vibration of the balance, constitutes the essential difference between one watch and another.

A watch is described by the form of its escapement: there is the vertical, or verge watch, but as they are nearly out of date for good watches, I shall not here describe them.



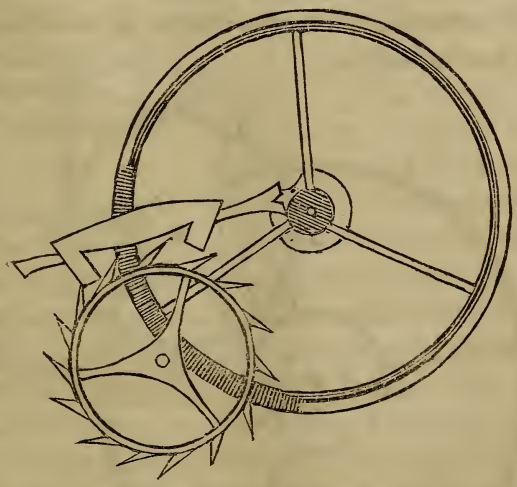
Verge Escapement.

The horizontal, or cylinder watch, has the impulse given by the teeth of a horizontal wheel acting on a hollow cylinder, which forms the axis of the balance.



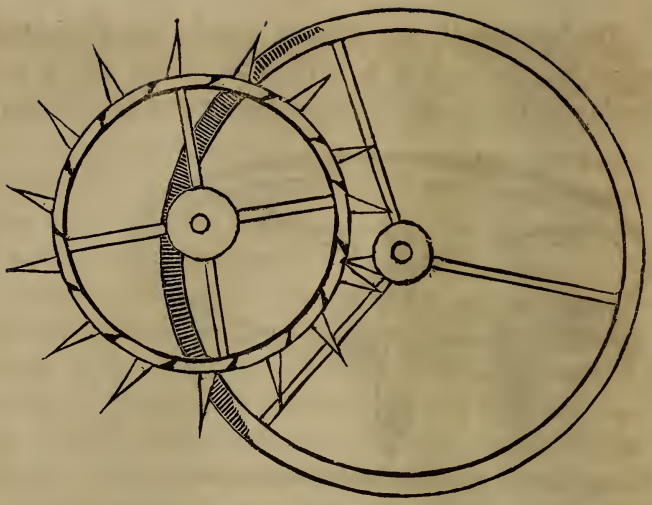
Horizontal Escapement.

A lever, or anchor watch, has the impulse given by a lever attached to anchor pallets.



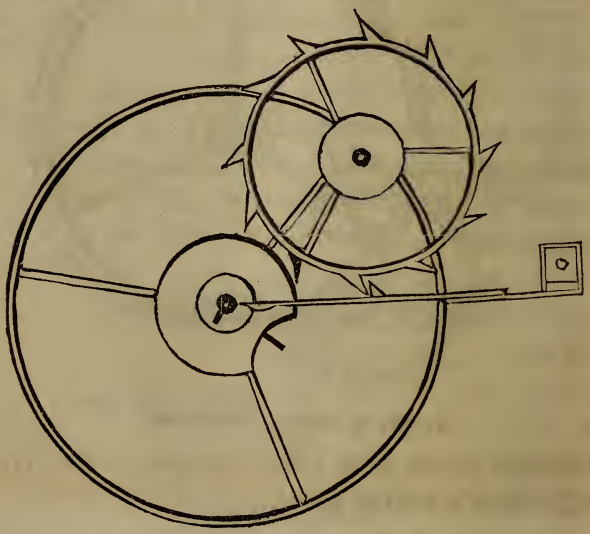
Lever, or Anchor Escapement.

A duplex watch is so called because it receives its impulse from a double wheel.



Duplex Escapement.

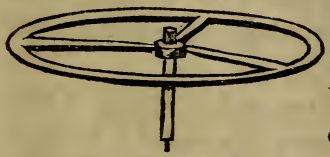
A chronometer watch is that which has the vibration of the balance free, or detached from the influence of the maintaining power, except at receiving its impulse and unlocking.



Chronometer Escapement.

Several escapements, such as the verge, the vergule, the rack lever, &c., had to be abandoned. My uncle, who was one of the most ingenious workmen in Switzerland and London, and maker of musical watches and repeaters of every kind, and with whom I worked fifteen years, spent upwards of five years in inventing and trying new escapements, but had to abandon the idea of making anything better. It was his opinion, and is also mine, from experience, that it will not be possible to get escapements with less friction, and that will maintain their accuracy better than the chronometer, duplex, or even lever, if properly made. Still I may be mistaken, as many things have been achieved within a quarter of a century, which would then have been thought fabulous.

The balance of a watch is a wheel nicely poised upon its axis, having its greatest weight at its periphery.



Balance of Watch.

A balance properly placed, with its pivots in their holes, but resting on the points or ends, would, when put in motion, revolve on its axis; but if a spring so constructed as to bend in either direction in which the balance will turn, was to have one of its ends fastened to a point independent of the balance, while the other end was attached near to its axis, an impulse then given to the balance would only cause it to move as far as the force given was able to overcome the resistance of the spring, when the resistance becomes equal to the impulse given; the balance stops for an instant, and then is driven back by the elasticity of the spring to a distance nearly double to that through which

it passed in its first motion, and thus continue to vibrate until the friction and the resistance of the air bring it to rest.

Balance and Hair Spring.

A spring thus applied is called the balance or hair spring, This spring has been frequently noticed as illustrating the great value a small piece of steel may acquire from manual labor; it is perhaps more remarkable for its extreme delicacy, four thousand of them weighing scarcely more than an ounce, while the cost frequently exceeds four thousand dollars when used for fine work.

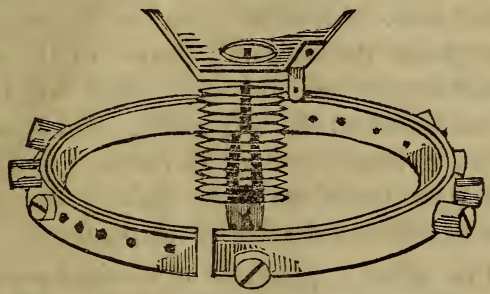
When the balance is at rest the spring is inclined neither way, this position is called the point of rest; and the motion of the balance when influenced by the hair spring, is called vibration.

The application of the balance or hair spring is the greatest improvement ever made in a watch; since it rendered a comparatively useless machine capable of going with accuracy; and now that the principle can be more easily applied, although perhaps not better understood, it offers the means of measuring time equal to a pendulum.

The first watches were made without any balance spring, but with a vertical wheel which moved the balance backward and forward; and instead of the chain now used, there was only a piece of cord, like a very fine violin string, to convey the motive power of the main spring to the wheels. This balance spring can

produce astonishingly varied effects from difference in the length and tapering, the principle being the stronger and shorter the spring the quicker will be the vibrations.

The hair spring of watches are made flat on account of the small space for them to work in; but where there is room, the isochronal spring is applied. In marine chronometers for the use of ships, they are made in a spherical form; the thickness of the spring being the same the whole of its length instead of tapering, as they are easier of execution and better adapted for the regulation of time.



Marine Chronometer Balance and Spherical Spring.

These remarks will not be thought too detailed if we consider that the correctness of the watch as a measurer of time, is mostly dependent on the correct principle of the escapement and of the hair spring.

The curb or regulator, is the part used for regulating the watch. The purpose is to shorten or limit the motion of the balance to make the watch go faster, and to lengthen it to make the watch go slower.

When a good watch has been produced, with the main spring acting with equal power from the instant of being fully wound to the termination of its time of going, the

wheels and pinions perfect in all their parts, the escapement on a good principle and properly executed, and the balance spring so perfect as to make all its vibrations in equal time, even then the watch will vary in the time. It will show a variation upon every change of temperature, unless it be compensatory.

A watch may be said to be a metallic thermometer, for the slightest change in the temperature affects its going in proportion to the change: heat enlarging the balance and lengthening the hair spring, (independently of the effect produced upon all the other parts) which will make a watch lose, while contraction from cold will make it gain. An action upon the balance, bringing the weight at its extremity nearer to the centre, will cause it to gain, and the same effect will be produced by an action on the hair spring, which will either shorten its length or limit its motion; and both of these means are made use of to make watches keep equal time in different degrees of temperature.

When this effect is produced it is called compensation, and is obtained from the different degrees of expansion in metals, and for this purpose the compensating balance is applied to good watches. The compensation balance has its circumference composed of two metals, brass at the extremity and steel within: and as the rim is cut in two parts will expand or contract with every change of temperature. When heat causes expansion of the spring and balance, it also acts on the brass at the extremity, and causes that part

Compensation Balan

of the rim which is cut, to be brought nearer the centre, and this motion is so regulated by means of screws or weights, as to compensate for the expansion, and enable the watch to measure equal time, under the different degrees of heat and cold.

But compensation balances should not be used unless the other parts of the watch are perfect, otherwise they are not so good as the plain gold or steel round rim balance. I have always found the latter kinds to keep very good time, and where the price is limited, are to be preferred, as a bad compensation balance is but a detriment to an otherwise good watch. The compensation curb is frequently applied to watches. Its use is to limit or extend the motion of the balance spring, by a self moving action caused by change of temperature. The principle is the same as in a compensation balance, the motion being produced by the inequality of expansion in the two metals, (brass and steel,) of which it is made.

There are many who expect an accuracy incompatible with the nature of the machine; indeed, positive accuracy can never be obtained, until an unchangeable material is discovered, of which the work can be constructed.

One of the best time keepers and finely finished watch that I ever saw, was one made in Geneva, or Locle, which a friend of mine purchased in California, and I had it to clean. It had the plates and bars for the wheels made of nickle, the wheels were made of gold, it had a compensation balance, with isochronal hair spring; in short it was a (chef d'œuvre) for a Swiss watch, with an anchor escapement.

It is frequently forgotten that time differs in every spot east or west of the place at which the watch is set. At the present speed on rail roads, two hours travelling may make the travellers watch show some two or three minutes faster or slower, than the local time of the place at which he arrives. In this case, the difference must be added or subtracted to avoid disapointment when travelling. It has been said "that no man ever made a true circle or a straight line except by chance," and the same may be said of any machine which measures time exactly. These remarks neither lessen the perfection or usefulness of watches. They are among the highest specimens of human ingenuity, and indispensable in the present state of society.

THE SELECTION OF WATCHES.

Were it possible to give rules for the selection of watches, society might be benefited, as the yonng man who has a bad watch is less likely to obtain habits of punctuality, than he who has a good one. I once heard an anecdote of two young persons who were allowed to select watches for themselves. One chose a plain watch, from being told that its performance could be depended upon. The other, attracted by the elegance of the case, decided upon one of inferior construction. The possessor of the good watch became remarkable for punctuality, while the other, although always in a hurry, was never in time, and discovered as a celebrated writer justly observes, "that next to being too late, there is nothing worse than being too early." Unfortunately, no efficient instruction can be given, as none but a workman possessing the highest knowledge of his art, is capable of forming a correct opinion, and a watch must be bad indeed for an inexperienced eye to detect the defects, either in its principle, or its construction. Even a trial of a year or two is no proof, for wear seldom takes place within that time; and while a good watch if in order can but go well, a bad one may by chance occasionally do so.

I have myself seen some of the old rack lever watches that were more than fifty years old, and worn constantly, nearly as good as new, by having been properly attended to, and in time. It is not sufficient that a watch be well constructed, and on good principles.

The brass must be hard, and the steel properly tempered. The several parts must be in exact proportion, and well finished, so as to continue in motion, with the least possible friction. It must also be made so that when taken to pieces, all its parts may be replaced as firmly as before.

A watch thus constructed and properly adjusted, will continue its motion and correct performance for years without trouble, and with little expense, except occasionally cleaning. A bad watch is one to which no more attention has been paid to the proportions of the parts or durability of materials, than was necessary to make it perform for a time. It is either the production of inefficient workmen, or of those who being limited in price, are unable to give sufficient time to perfect their work. There is a great fault in many watches and movements, sent both from England and Switzerland—they are not properly examined, adjusted, and regulated before exported.

Formerly, and it is still the case in many instances, the most eminent watchmakers were all practical workmen. At present there are but few manufacturers who work themselves, and if they do, have not time to see to every watch sent away. Those who value the reputation of their watches, have a practical workman, one who understands thoroughly every branch of the business, who is called the examiner, whose duty it is to take every part, and see that it is properly made, adjusted, and put together on correct principles; for where a piece of mechanism like a watch is made in so many parts or pieces, it is next to impossible but some slight oversight or imperfection may occasionally occur.

The examiner or manufacturer then regulates every watch or movement, (if correct,) before being sold.

But latterly, the competition for cheapness has been so great, that in many cases the examiner is dispensed with, as good examiners are paid very high wages. It being necessary for him to have considerable skill and experience before being entrusted with such an important position. Also many watch manufacturers have not the opportunity of examining every watch, in order to fulfill their orders in time at the busy season, and many watches, particularly cheap ones, are merely *going machines*, and not *timekeepers*.

Another fault with many watches sent from Europe to this country, is that the oil has not been changed; the oil mostly used in the manufactories will not do in this climate, and but few watches will perform correctly until the oil is changed. Still another fault, and one which often brings discredit on a good maker, particularly in cheap work, is that when the watch or the movements are cased in this country, the movements go in the hands of workmen who merely take them down for casing, or are paid so little for the work that they cannot properly examine them, and correct any oversight or imperfections in manufacturing, and frequently have to do the work in great haste; if the balances only vibrate with a good motion, it is all that is wanted of them. Bad watches in some instances with strong springs will go well for a time, but as they wear from friction, they require frequent repairs which cannot effectually be done, for in correcting one defect in a badly constructed watch you frequently find several others, which could not be discovered before.

The principal cause of imperfect watches is the universal desire of obtaining them for as little money as possible, and to reduce the work of watch making to the same value, is to compel good workmen to produce bad work.

When an art is difficult to learn, requiring much knowledge and study, with years of experience the number of really good workman will be few, and therefore employed by those who can offer the best renumeration. Few can judge of a machine, the accuracy of which depends upon the most minute correctness of principle and execution; it is not wonderful therefore that there are numbers of bad watches, since a portion of the public considering them as mere ornaments, or in many instances only bought to trade, and not for use as timekeepers, procure them from dealers who, however just and honest they may be, can never possess that knowledge, which is only acquired by long practice in that particular art, and may therefore be themselves deceived. Those also who in order to meet the general desire for cheapness sell at low prices, can only do so by producing inferior watches, for a greater division of labor or use of machinery can scarcely be brought into operation. The workmen are therefore compelled to do the greatest quantity of work in the least possible time, and good work in watches must not be slighted. It is often supposed that the principle on which a watch is constructed, must determine its quality.

This is far from being the case. A duplex watch may be very bad if not well made, and the escapement in its true principle. A chronometer watch with the

same fault is still worse, while a common vertical watch may be good if well made. I have seen good vertical watches which had been in constant use for upwards of fifty years, with new verges put in occasionally, and kept regularly cleaned, which were still much better than many of the full jeweled levers made at the present time. To make one watch better than another, execution must be added to principle. It may be here mentioned the undue importance is frequently attached to watch jeweling; many low priced and bad watches have eight or ten holes jeweled, while many that are good have but four. To state the number of holes which ought to be jeweled, would require details ill suited to a work which is merely elementary. But when it is known that in common watches the holes can be jeweled in Europe at less than fifty cents each, it will be seen that the number of holes jeweled affords no criterion by which to estimate the value of a watch. But in fine watches which are jeweled with rubies and are highly polished, the cost is four times more. Therefore the judgment of the seller may be fairly questioned, should he attach much importance to the number of holes jeweled. The high sounding description, the maker's name, (unless it is genuine,) the offered trial, the enticing cheapness, are often effective baits to the short-sighted. It has already been shown that the principle of a watch is no proof of the excellence of its quality, the beauty of its case &c., in no way affect the works, and even the offered trial is not a sufficient test. The purchase of a very cheap watch may teach the useful lesson, that low price is not exactly the word for cheapness. The size and form of a watch are de-

termined by fashion or convenience, and although the appearance is of less consequence to a person buying one for his own use than the quality, yet no reason exists why a good watch should not be handsome, while many that are showy and handsome are good for nothing as timekeepers, and are merely useful as articles of trade.

The individual who wishes to procure a good timekeeper, should apply to a watchmaker or dealer of known honesty and ability in his art or business, and who therefore should be implicitly trusted. The various prices will point out the comparative qualities of the works, for the external ornament of a good watch form but a small portion of the expense. In regard to choosing either an English, an American or Swiss watch, circumstances must in many instances determine that. There are good makers in each country. If you have a preference for any particular maker, be sure to get one with the genuine name engraved on it. For a moderate thick watch, choose an English or American watch; for a thinner watch, or one of small size for a lady, take a Swiss one, as Swiss watches are to be preferred for small size, style, and lowness of price. With the exception of size, the appearance of a watch is totally independent of its quality as a machine—it may be handsome, yet bad. But, a good watch is seldom unsightly, for the knowledge of form, indispensable to a good watchmaker, is doubtless the reason why watches made by good makers generally look well, although they have become antiquated. With regard to size, although there is no necessity for the large thick watches worn some years ago, yet those

very flat and small are deficient in the first principles required for correct performance and durability, and are more easily spoiled by unskillful workmen in repairing. Although all the parts may be in equally reduced proportions, the very particles of the metals, the more rapid decay of the small portion of oil which can be applied, and the limits to the visual power of man, must ever prevent a very small watch from being as serviceable as one of moderate size; that is, the smallest consistent with accuracy and durability. The large, thick, old style of watch is less absurd than some now made. Reason may justify the one, while fancy is the only apology for the other.

There are other circumstances which must also determine the choice. If the purchaser is going in parts of the country where he may not find skillful workmen in case of accident or repairs, he should procure a watch constructed on a principle generally understood, and which can be easily arranged when out of order.

The preceding remarks are all that suggest themselves as useful to the inexperienced in selecting watches. More detailed instructions would explain the construction of the machine, and might be interesting to a few, in particular to watchmakers—there are works published for their use and instruction; but to be able to discover the quality or imperfections of a piece of mechanism so minute and complicated as a watch, requires knowledge and patience attainable only by long experience, I will therefore explain the different kinds of watches made, and leave it to the purchaser to make his selection.

MERITS AND DEFECTS OF THE WATCH.

THE VERTICAL OR VERGE WATCH.

The vertical or verge watch requires to be made thick, but on account of the frequent expense of a new verge, which will wear from continual friction and action of the escape wheel on the pallets, also from the fashion of wearing flat watches, there are but few verge watches worn now, and those that are made are generally of an inferior quality; but there are still some few good ones, and when in order, will keep tolerably good time.

THE HORIZONTAL OR CYLINDER WATCH.

The horizontal or cylinder watch, when well made, will perform with considerable accuracy, and if not suffered to go too long without cleaning, will continue serviceable for many years. There is however much friction in the escapement, and a great wear takes place if they are allowed to continue in motion after the oil has become dry. When they commence varying more than two or three minutes a day, they should be submitted to the inspection of a good watchmaker, and cleaned if neeessary. If they have been recently repaired, it may be only the oil that is worn off the cylinder, and by putting fresh oil to it the watch will frequently regain its motion and perform for some time with accuracy if it was well made.

DUPLEX WATCHES.

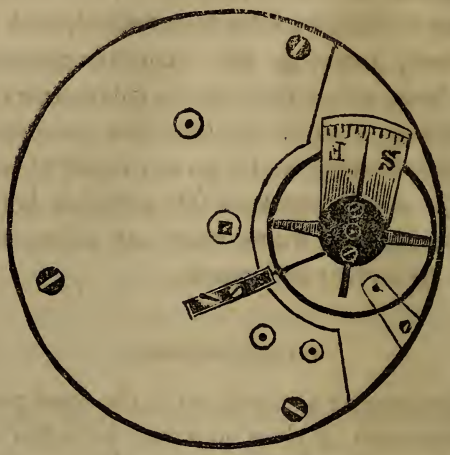
A duplex watch with a compensation balance, when well constructed, will, with ordinary care on the part of the wearer, keep time with the greatest accuracy. These watches are however delicate, and should not be worn when violent exercise is intended, such as riding on horseback, jumping, &c. Another reason is that except in large cities, there are in this country but very few workmen who understand the principle of the escapement properly, and who can repair them as they should be. A bad watch on this principle is (the chronometer excepted) worse than any other, and more expensive to correct and repair.

CHRONOMETERS.

The chronometer escapement is the most perfect for the measurement of time, and one with the least friction. It is the only one employed in marine chronometers. The term chronometer is applicable to all timekeepers, but it is now more usually applied to marine timekeepers only; those being large their several parts approaching in size to those of a small clock, require less delicacy of workmanship than pocket watches of the same construction. The high office which marine chronometers have to fulfil demands an accuracy far beyound what can be attained by a machine as small as a watch. A marine chronometer is always in one position, being placed in two boxes made and fitted in such a manner that whatever the rolling or pitching of the vessel is, the dial is always uppermost, which accounts for its accuracy, and which could not be ob-

tained in a watch, as no matter how well the escapement is made it will be liable to set or stop by some external motion.

THE HALF AND THREE-QUARTER PLATE WATCH.



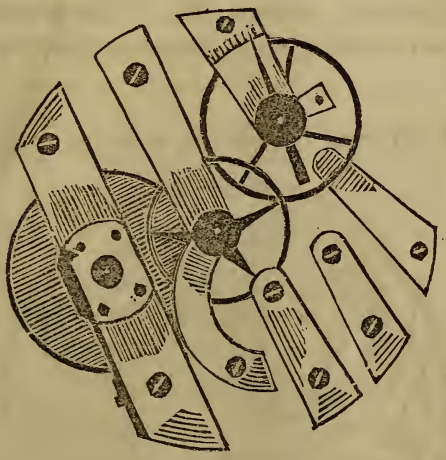
Three-quarter Plate Watch.

Some watches are made with the half and three-quarter plates, on the English principle, with chain and fusee. The idea first originated with Mr. Dent, and a watch case maker, now in New York, (Mr. Cuendet, 80 Nassau,) was the first person who made the cases to that style of watch in London. The balance is there placed at the side instead of being in the middle of the upper plate, as in ordinary watches. By this arrangement they are enabled to make them considerably thinner. They are made with cylinder, lever, duplex, and even chronometer escapement. They sometimes have a cap, and open from the front, like other capped watches, but I prefer them without

the cap, and to have the case made to open similar to most of the Swiss watches, as otherwise they are more liable to accidents in opening the movements or caps. If well made, they are equal for timekeepers to those on the old plan, and not more liable to get out of order.

Swiss watches are sometimes made on this plan, but they are usually without the fuzee, but either kind will perform well if properly adjusted.

THE LEPINE WATCH.



Lepine Watch.

The watch usually called Lepine was first made in Paris about fifty years ago, and I believe that Lepine, a celebrated maker at that time, was the inventor, from whom they are so called. The object of having the wheels held by bars and screws, which any person having opened one has seen, was to make the watch flatter than the English could make theirs. Breguet, the celebrated maker of Paris, made all his flat watches

after that fashion. He also was the inventor of an improved manner of fitting the going barrel on the bar of the ratchet, and also of the key named after him, to prevent winding the watch the wrong way.

Watches made now in that style are frequently called Lepine Watches, although they are made with every kind of escapement. Like the half and three-quarter plate, if they are well made, the bars properly fitted, and the spring well adjusted, they will go equal to any other kind of watch made without a fusee, with the same escapement, except the chronometer, which requires more solidity than there is usually to this kind of watch.

THE CHINESE, OR CENTRE SECONDS WATCH.

Chinese or Centre Seconds Watch.

The centre seconds or Chinese watch is so called on account of first being made for China, so that they could see the watch go plainer than by having a small

seconds hands. They are made with the duplex escapement, and having a very large balance. The inner back of the case is generally glass, through which all the works can be seen. The brass works are ornamented with engraving, which with the bright and blue steel screws, has quite a showy appearance. I have seen many with the plates made of steel, and all the other works in all kinds of variegated colors, to make as much show as possible. Thirty-five years ago I worked on them altogether, and I see no difference with those now made. I cannot recommend them strongly as timekeepers, in particular now when they are made so cheap. One very great fault about them is, that the beat is too slow beating a second at a time. It having been well ascertained by practice and experiance, that quick motion watches regulate better than slow ones, and are not so likely to be affected by external motion.

The Chinese always had them made in pairs, and every part, even the screws had to be so exactly alike, that you could not tell one from the other, only by the numbers of the watch; even in regulating, the hands of both watches had to move together. The reason was that the Chinese wore two watches, which they carried in a pouch or pocket, fastened on each side. They say when a watch stops, it is dead, and cannot be set going again, and if one stops, they still have the time by the other; but if they both stop, they get others, as they never think of having them repaired. I suppose this idea originated with them on account of not having watchmakers convenient to repair them.

INDEPENDENT SECONDS WATCHES.

Watches with a long second hand in the centre were made many years ago chiefly in England, for the use of physicians, and persons wanting to measure time very accurately. But they did not move one second at a time, their motion was only as the vibration of the balance was one third of a second at a time. By further improvement, they were made to beat one second, but still there was a great defect, as in the Chinese watch; when you stopped the seconds, you had to stop the going of the watch altogether, and thereby lose the time. As a further improvement, you can stop the long seconds hand in the centre without altering the regular time, and see when or at what time you stopped them. They are made, now that there is two separate trains of wheels, two springs, and two sets of hands, by stopping the centre seconds, which is done by a piece placed outside the case; you stop one set of hands while the others keep going, and you still maintain the regular time. When you wish to set them again together, you do it by a square at the back of the case, without any injury to the watch, nor does it interfere with the regular time, as they are independent of each other, more particularly when the centre seconds are stopped. For those interested in an operation performed in small portions of time, some being made to show one fifth of a second; they are very useful, such as timing horses, &c. With the assistance of a seconds watch, and some slight calculations, many interesting facts may be ascertained. If a gun be fired by a vessel at sea, the distance may be know by observing the number of seconds which elapse between

the flash and the report. In mild weather, sound travels at the rate of 1123 feet in a second; if therefore the report of the gun was heard five seconds after the flash had been seen, the distance of the observer from the gun would be 5615 feet, or rather more than a mile. This is merely approximation, for the velocity of sound varies according to the density of the atmosphere. In dry frosty weather, sound travels at the rate of only 1080 feet per second.

A person traveling may ascertain his rate of walking by the aid of a slight string, with a piece of lead at one end, and the use of a seconds watch. The string should be knotted at distances of forty-four feet; this distance is the 120th part of an English mile, and bears the same proportion to a mile that half a minute bears to an hour. If the traveler when going at his usual rate drop the lead, and suffers the string to slip through his hand, the number of knots indicate the number of miles he walks in an hour. This is similar to the log line for ascertaining a ship's rate at sea; the lead in this case is enclosed in wood, (from whence the name) that it may float; the divisions are called knots, and are measured for nautical miles. Thus, if ten knots are passed in half a minute, they show that the vessel is sailing at the rate of ten miles or knots in an hour. A seconds watch would here be of great service, but the half minute sand glass is in general use. The use of a seconds watch is indispensable to the physician, to enable him to ascertain correctly the duration of spasms, convulsions, pulsations, &c. With the aid of a seconds watch, a person can count his pulse when in perfect health, and ascertain the number of

beats in a minute; this would enable him to let the physicians know (when necessary to consult one) how much the pulse differed from its usual rate, otherwise it might happen to a person whose pulse was naturally quick, to have remedies prescribed to diminish the rapidity, which under these circumstances would be injurious. Independent seconds watches if properly made, are no more liable to get out of order, than those that have only one second hand, but they must be carefully used.

REPEATING WATCHES.

Repeating watches are expensive both in the first instance, and in the subsequent repairs, and the same objection may apply to them as to the chronometer and duplex watch—that is, the difficulty of getting them repaired. They are however, a luxury to those who can afford them, and are as capable of accurate performance as ordinary watches of the same quality, the repeating part not in any way interfering with the general works of the watch. Minute repeaters are difficult to execute, and uncertain in the continuance of their proper actions, as the small space afforded in a pocket watch is insufficient for the greater number of pieces. The same may be said of musical watches now nearly out of date. These watches are principally valuable as specimens of art. The musical and repeating watch together as they were made, may be fairly regarded as one of the triumphs of mechanism, which unfortunately can only be appreciated by a watch maker. The apparently complicated motion of a Jacquard loom, when seen may be understood, for although

composed of innumerable pieces, yet it has to repeat but few actions.

Much ingenuity is required for the construction of engines of various kinds, but frequently the first element of mechanics are sufficient to produce them, while in their execution space can generally be obtained, and power produced at will. But the complicated motions of a repeating watch requiring to be produced in so small a space, and with such perfect accuracy must be considered as one of the highest specimens of mechanical art. The writer when he first arrived in New York in 1832, had with him a repeater with duplex escapement; this watch was made by himself, each separate part having been made as he had learned the different branches. He brought it for the purpose of having a specimen of his work. The first watch which he repaired was a musical repeater, which had lain by for some time on account of the want of workmen to undertake it. It was given to him by Mr. S. W. Benedict, Wall Street, to ascertain if he really understood the construction; he succeeded in putting every part in good order. They have now become nearly extinct, and he has had but few of that kind of watch to repair since that one, although he frequently has repeating watches to do.

ALARM AND CLOCK WATCHES.

Alarm and clock watches lose their effect from the ear becoming accustomed to them. More noise in striking is generally required than can be produced by a watch, while useful alarms and clocks can be had at much less cost. The writer, when apprenticed, worked at a watch in London made for Arnold, which contain-

ed a clock that struck every quarter of an hour, and repeated the hours and quarters also at pleasure, and an alarm, all striking on different spiral springs. Thus with the watch part, it had four distinct sets of wheels and springs, and the escapement which was a Duplex; it had also five spiral springs for the striking.—Although the size did not exceed that of an ordinary English watch, the cost when finished in gold cases was four hundred guineas, (two thousand dollars.) But few such watches were ever made, neither ought they to be.

DOUBLE POWER WATCHES.

About thirty years since, there was a great demand in England for flat and small watches, but the difficulty was the want of power to the spring. After a great amount of labor, my uncle succeeded in inventing a movement with two barrels, and two springs, both winding by only one square at the same time, hence the name of this watch. The invention he sold to Messrs. Dwerrihouse, Carter & Co., of London, who patented it. For many years after they were all the fashion, as by this plan, English watches could be made as thin as Swiss ones, and perform better. They being very expensive, and the patentees having a store for retailing in the best part of London, found customers for all they could make, therefore they were not made for the trade, nor for exportation. This is also the case with the watches made in Paris by many of the celebrated makers, such as Breguet, Le Roy, Lepine, and many others, having made but few and at great expense, they are only found in the possession of the wealthy.

WATCHES OF FANCY.

Watches of fancy, such as those showing the hour through a dial, changing with a start, were absurd, and should be used as toys only—they are now out of date. Some very good watches, are made to mark the days of the week and month. There is frequently much skill and ingenuity displayed in their construction, but the purposes can better be accomplished by a well made clock of sufficient power.

Fancy has certainly placed watches in most inappropriate places—in the lids of snuff boxes, in shirt studs, breast pins, &c. The Elector of Saxony had a watch in the pommel of his saddle. The writer worked at the making of a repeating watch for George the Fourth (who was a great patron of the art.) to be worn on the finger ring; he had a cabinet containing specimens of every kind of new watch produced, and used to amuse himself by keeping them going, to see which performed the best. Watches made for ladies bracelets may however be so constructed as to be serviceable. I might describe other kinds of watches, such as those that wind up and set the hands by the pendant. Repeaters which strike the hour on a pulse piece at the side of the case for the use of the deaf; others with the figures raised on the dial, for the use of the blind, but as most of these watches are extinct, it will be useless to describe them.

There are also watches made to wind up and set the hands by the pendant; they do not differ from others, only in having no wind-up, or setting-holes, in the case. If they are well made, they are very convenient, as it saves a key, but if the winding-up part is not very correct, they are very troublesome and expensive.

This watch recommends itself for the simplicity of its construction, and will be continually improving in quality, if the manufacture remains in the hands of persons who will make it of a good quality, without regard to price. In case of accident it is easily repaired. But I would suggest to any of my fellow craftsmen having them to repair, to be particular to use none but the very best main springs, should new ones be required for them. There are many manufactories of watch cases, dials, &c., in this country; in fact, any part or parts of a watch can be made here, and by applying to any good watchmaker, he will make them, or get them made.

Watches whose cases open at the back by a spring, are not so secure and free from dust as those with a proper snap, which can be made to shut close, and open easily; springs are only necessary for wearers whose fingers are particularly soft or to raise the covers of hunting watches.

Hunting watches have a cover to protect the glass. and it will do so when sufficiently thick and convex, but very flat hunters neither admit of the necessary shape nor thickness; in many that are now made, particularly Swiss watches, the glass is nearly as liable to be broken from pressure, as it was when unprotected, and the difficulty of procuring another is much greater. When flatness is necessary, an open faced watch should be preferred, with a number of spare glasses, which a very little practice will enable any wearer to put properly in their place.

In giving advice with regard to choosing a watch, I have said nothing but what every good watchmaker or importer of good watches will acknowledge to be facts.

I have divested myself of any prejudice or partiality, and have only related what I have learned by practice, and the experience of forty years, and which I have endeavored to explain plainly without any technicalities.

I will now endeavor to be more explicit, and give my reasons. For a large thick or a three-quarter-plate chronometer, duplex or lever escapement, properly compensated watch, with a fuzee and chain, the English certainly claim the priority, they having been the first to apply, and the great practice and attention given by them to compensation.

The American watches being more simple in their construction, and easily repaired in case of accident, claim the next notice.

For a thinner or small watch, the Swiss must have the preference, as it is nearly the only kind of watch made there, and other reasons explained in a former part of this work. There is, in Geneva, a celebrated manufactory, wherein nothing but good watches are made, and it is well known to most of the best stores in the United States; every part of the watch is made in the same establishment. I have had considerable practice with them, and I have generally found that they are the most perfect that I have had in my hands.

I do not pretend that there are no bad English watches made, quite the reverse. I have always found that a bad English watch was worse and more difficult to put in good order, than any other.

For an ordinary or cheap watch, I should prefer a Swiss one, they having the facilities to manufacture cheaper than any other nation. Fine Swiss watches are made as correct and as accurate as it is possible to make them for the size and thickness, but the prices will not be less than for the English ones, although the style will be different. Common and cheap watches will of course always be made to keep pace with competition, and as an article of trade. I do not intend to explain their defects, I only endeavor to point out the merits of a good one.

I will now give such instructions as I am enabled, to keep it good, and it may possibly be the means of saving the reader some unnecessary expense, if he will take the trouble to peruse this little book throughout, as well as save us, (Pivots,) from being often erroneously blamed, however honest and on the *square* we may do our work.

NECESSARY PRECAUTIONS AND ADVICE TO PERSONS WEARING WATCHES.

The watch requires care, and it is not enough that the maker is one of character, and that a proper price has been given for it, unless necessary precaution is taken to insure good performance. The watch should be regularly wound up as nearly at the same hour as possible, since few springs are so equally adjusted as to pull with the same force during the whole time of action, which is usually about thirty hours, therefore by winding every twenty-four hours, it will leave six hours for the weakest part of the spring to remain idle.

Always have a key with a good pipe or square, and one that fits properly on the square of your watch, for if it does not fit good and firm, it will be apt to slip, often breaking either the chain, the ratchet, or the click. If the square of your watch is too short, or worn nearly round, get a watchmaker to repair it, or make a new one. Be particular to wind your watch the proper way. English watches, or those with fuzee and chain usually wind to the left, and almost all the Swiss ones, or those with the going barrel, wind to the right. While being wound, the watch should be held steadily in one hand, so as to have no circular motion, which always produces variation in the vibration of the balance, and sometimes considerable derangement in the escapement. It is better to keep a watch continually going, than to lay it by and wind it up occasionally.

The going of the watch keeps the oil in a limpid state, and the watch keeps its regulation better. Many will (when their watch is first wound up, after having lain by for some time,) say, "I have not wound or used it for so long." They do not consider that the oil will thicken or evaporate, and cannot be in the same state as if the watch was kept going regularly. Always wind steadily and slowly, holding on the key to hold the spring, while the click slips from one tooth to the other, otherwise there is danger of breakage of chains, clicks, ratchets, &c. The chain or spring is sometimes broken by winding a watch too fast. When a watch stops in winding it, if in one with a chain, it is frequently by the going fuzee works not being correct, or it may stop by the escapement not being correct. In a watch without a chain, it may also be by some defect in the escapement, or by the stop works on the barrel being out of order; in either case, take it to a watch maker.

Watches frequently stop by the springs breaking, owing to the changes of the atmosphere, particularly in cold weather. That is one of the accidents which cannot possibly be avoided by the best workmen, and in the very best watches. It is impossible to make a main spring which will not be influenced by the sudden changes of the weather. Therefore, if the spring of your watch breaks, do not blame the watchmaker, as they often break from the same cause while the watch is in his care. I have frequently on taking watches out of the safe in the morning, that had been put in good order on the previous evening, found several with the springs broken; in that case, it is ge-

nerally more loss to the workman, than to the wearer of the watch.

Be not afraid that your watch will not go as well after a new spring has been put in, as before; if a good new spring has been properly put in, your watch will go as well as ever.

English, or watches with chains, will usually wind about four and a half (4½) turns every twenty-four hours, while those with a going barrel about three and a half (3½) turns; this will partly serve as a guide to ascertain if your watch winds right.

If the springs or chains break frequently, be sure there is some defect in the stop work, which must be corrected by a watchmaker.

Many persons say, "I have overwound my watch;" it may be possible to do it in winding very fast, and in a hurry. If the stop works of a large and thick watch, or one with a chain are in order, it will take a strong key to resist the strain that you can give to overwind it If not in order, the chain will break. In a flat watch, or one with a going barrel, if the stop works are not in order, or there is only one, or perhaps none, and you force it, you will break the spring, or some of the teeth of the wheels, or pinions, and sometimes both: if when the spring is broken you keep winding, you are likely to break or injure some other parts of the works.

Be particular never to trifle with a good watch, or use it as a toy, but as a piece of delicate and complicated mechanism, requiring great care; by so doing, you may preserve your watch, and avoid a great deal of expense for repairs.

Before winding or setting your watch, it is advisable o see that the key and the inside of the pipe containt no dirt or dust that may get on the winding or setting square, and from thence to the wheels or escapement.

When a watch is hung up, it should be perfectly at rest. If hung on a round hook without further support, the motion of the balance will generate a pendulous motion of the watch, and will cause much variation in the time. Powerful watches should never be laid horizontally, unless placed on a soft substance ; if placed on a smooth flat surface, from the convexity of the glass or case, the watch only rests on a point, and the vibration of the balance alone is sufficient to produce motion in the watch.

Should a watch stop, see if the hands rub on the dial, and are free of each other, if they are caught together you may free them yourself by taking the point of a small knife blade, and disengaging them ; your watch, if there is nothing more the matter with it, will then start by giving it a slight shake.

Frequently after a watch has had a new glass put in, it will stop ; that is through the glass being too flat, and touching either on the centre pinion, or by pressing on the hands ; in that case, blame the person who put the glass in, and let him put another in ; if there is not, as in very flat watches, room enough for the hands to work free of each other, it will often be advisable to have the cover of the case raised a little ; in thin watches, the case may have been pressed flat in the centre by wearing.

If any thing is the matter with your watch which you cannot discover immediately, do not try to put it

in order yourself, and meddle with the works, but show it at once to a good watchmaker. I have had watches to repair in which the wearer thought he could detect the defect himself, in opening it, he would see the spiral spring, and think that it was some hair which had no business there, and in trying to remove it, would spoil or break it.

Many watches are injured by the wearers thinking that they can make them go by opening, winding, and shaking them.

Watches should be opened as little as possible, merely to wind, set, or regulate them. By continually opening them, particularly the inside cap, opportunity is offered to minute particles of dirt from the case, or otherwise, to intrude into the works. I have known many watches which had been recently cleaned, stopped by some small particle of dirt sticking fast between the teeth of some of the wheels, particularly near the escapement.

Should a watch get wet by falling in the water or otherwise, if you are not near a watchmaker, as soon as possible open it, and pour in some oil, any kind will do in an emergency, but olive oil is the best; as soon after as convenient, place it in the hands of a watchmaker, and if attended to in time, the whole movement or at least many parts may be saved. If left too long without oil, to prevent rusting, particularly if wet with salt water, the steel works will be past repair.

If a watch is not regular in its vibrations, which can be discovered by any one having a good ear, take it to a watchmaker, and let him correct it. This only applies to the verge, cylinder, anchor, or lever watches;

in the duplex and chronometer escapement, the beat or vibrations being very different, none but an experienced watchmaker will know if they are right; with these last escapements, the ear is not to be depended upon entirely.

In setting your watch to time, be particular to do it as follows:—When the hands set from the front part, which may be known by noticing a square above the minute hand, always set them with the key on the square; never do it by pushing the hands, as in most cases you would break or bend them. In Lepine watches, or in any of those setting from the back, the minute hand is fitted on a round pivot, instead of a square, and by pushing it, you would be sure either to loosen, break or disarrange the minute from the hour hand, so that they would neither perform together, nor point right.

When the hands of a watch set from the back, which can be easily ascertained by their being two holes to the inner back of the case—one to wind the watch, the other in the centre for the hands—take your key, and putting it on the square in the centre, you then can turn the hands as you wish. But do not open the glass, as, in very flat watches, it will frequently break or fall out, and will cause trouble to replace it.

In independent seconds watches, there are four holes in the back—one to wind the regular time or watch part, one to set it, one to wind the seconds part, and one to set that also.

Many persons think it injures a watch to set it back; it is a mistaken idea, as a watch will not be injured by it unless the pinion which carries the hands

turn hard, in which case it would injure it as much to turn it forward as to set it back; and recourse must be had to a watchmaker.

Sometimes the pinions of the hands are too loose, and are too easily moved; the watch will then continue to go, but the hands will not mark the correct time. This can be easily remedied by a watchmaker, who will correct it without taking all the watch apart. Where the case opens at the inner back, care must be taken to close it well, as otherwise the outer back will not shut down properly, and thus dust will be allowed to accumulate in the works.

In English watches, if you have to take off the cap to regulate them, or for any other purpose, in replacing it be sure to put it on straight or flat. I have seen many watches that, by the cap being put on sideways, the chain has been pushed flat on the barrel; the consequence being, that in winding the chain will either slip off the cone of the fuzee, or break. After it is in its place, be sure to fasten it properly by the spring at the top of the cap. If the spring does not hold it down properly, recourse must be had to a watchmaker. If the cap is not properly fastened in its place, the watch will be in danger of stopping by the balance touching it. Sometimes the chain will slip off the cone of the fuzee in winding. This is a very bad defect, as the more it happens, the more it wears the groove out in which the chain works. In this case, recourse must be had to a watchmaker to correct it, or to put on another chain: at other times, the chains, particularly in cheap work, are too brittle, and continually breaking. It is useless to mend them. It would be better

to put on chains of better quality. The English chains are the best, and not so brittle as the Swiss ones.

Particular care should be taken to keep the works of a watch clean, even though perfectly free from dust; they ought to be taken to pieces and cleaned when the oil has become dry, as, without this precaution, the best watches would be spoiled. It is good watches that will continue to go, until friction and wear prevent their going any longer; they are the most liable to be neglected.

Watches, under ordinary circumstances, should be cleaned every second or third year at farthest. Those that are small and flat, or have complicated works, require cleaning more frequently. Neglect in this particular is the reason why many imported watches are injured by not being attended to in time, and having the oil changed. They may have been made some time previous to being sent out; then the journey here, then from the importers to the dealers, where they may lay for a long time before being sold; so that years may possibly elapse before the wearer has it in his pocket. Therefore, is it to be expected that the watch can perform correctly? If it does, all the time you keep it going, you are only causing it more injury.

No good watchmaker will allow a watch to go too long without changing the oil.

When an accident has happened to a watch, or even if it simply requires cleaning, care should be taken to place it in the hands of an honest and competent workman.

The possessor of a good picture would doubtlessly inquire into the ability of the artist before he entrusted

it to him to retouch. This caution is equally necessary for a watch, as many of the best construction have sustained irreparable injury at the hands of unskillful workmen. Even inferior watches, which are by far the greater number, require the aid of better hands to repair than those that constructed them. A good watchmaker may, in some cases, by judicious alterations, and giving a due proportion, make a watch to perform tolerably well, which a bad workman never can do, as he does not understand the principle of the machinery he is working at, and will more frequently make such alterations as only to make bad worse.

If the watch does not go its full time, from twenty-eight to thirty hours, there may be some defect in the stop-work which prevents it winding up in full, or sometimes the hook at the end of the spring may break and the watch still continue to go for some time after. If the spring is broken toward the centre, the watch cannot go; hence the difference. You must apply to a watchmaker, who can soon find out the difficulty. Frequently, after being repaired or cleaned by even the best workman, a watch will, when worn, require a little attention to its regulating. The watchmaker cannot wear all the watches he has to repair; neither can he know the different habits of his customers.

Many persons will say—"I have had my watch repaired, and it does not keep time." It is often an injustice to a good workman who may regulate a watch very closely while in his hands, but when worn by the owner, and the different way in which he uses it, causes it to vary; therefore, it will be necessary to attend to it, and, should it vary, alter it according to the wearer's use of it.

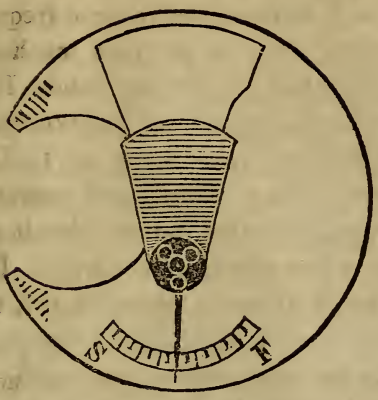
Almost every careful person can regulate his own watch as well as the watchmaker, who frequently alter so many, that they may forget how much and when they altered the regulator of your watch. I have often asked persons when they wished to have their watches altered, when did you set your watch? The answer frequently is—"I forget exactly; it may be about a week or ten days." In that case, how is it possible to know how much to move the regulator? It is essential, in order properly to regulate a watch, to do it at stated times.

If your watch is a French or a Swiss one, and loses time, move the curb or regulator towards the F or A to make it go faster; if it gains toward the S or R to make it go slower. These letters are engraved on every French or Swiss watch, F signifying fast, and A advance, and S signifying slow, and R retard, although on

Swiss and Three-Quarter Plate Watch Regulator.

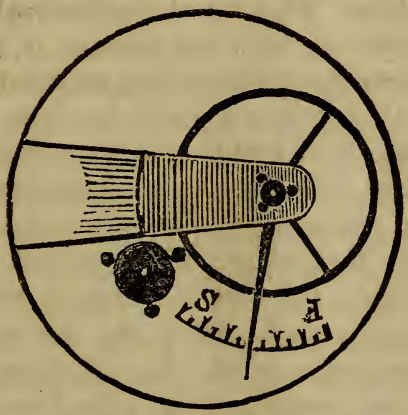
most of those made now, they are engraved in full, slow

and fast. In English watches with caps, the regulator



London Regulator.

is either on the cock or on the plate, and you will ge-



Liverpool Regulator.

nerally find them engraved on the plates in full—Slow and Fast. Move the regulator but very little at a time, until you get it right, but be sure and set it by the same time-piece, and by one that can be depended upon. The correct time can always be found at any respectable

watchmaker's. If you have moved the regulator or curb as far as it will go, and your watch is not regulated, you must take it to your watchmaker, who will either lengthen or shorten the hair-spring, and put the curb in the centre, where it ought to be. A watch regulated to keep time in the pocket will, when not worn, gain a minute, and perhaps more, per day. The regulator must not in this case be altered, as the watch, when again worn, will lose as much as it had previously gained. Should a watch which has gone well for some time suddenly vary a little, without change in the temperature, the hands only should be set, as the irregularity may have been produced by some external motion.

Few watches are correctly compensated for the effects of heat and cold, and changes of the temperature will produce corresponding variation in the rate of going. If, therefore, a watch has been exposed to a greater degree of heat or cold than usual, the hands may be set to time, but the regulator should not be altered. A watch should be made to go to time at the ordinary temperature of the season. Cold will cause it to gain, and heat will cause it to lose; thus a little attention will enable the wearer to know when it is necessary to alter the regulator.

Should your watch suddenly gain from one to two hours a day, which is sometimes the case, after a watch has had some very severe motion, such as a fall, a blow, or a sudden jerk, let a good watchmaker see to it, and he will show you that two turns or coils of the spiral or hair-spring have got together between the pins of the curb, and, giving the

balance a very quick and short motion, has caused it to gain so suddenly.

The same jerks or falls, &c., may, on the contrary, have caused the spring to get out of the regulating pins, and then the watch would lose considerably. Any honest watchmaker will correct it for you in a few minutes at a trifling charge. But if this defect happens frequently, or a slight jar causes it, there is a defect either in the curb or in the spiral spring which must be corrected; or, if the curb moves too easily, that too must be corrected, as it may be moved by external motion; then it would be impossible to regulate your watch.

Watches that stop when being worn, and go on again when taken out of the pocket, without any apparent cause, have sometimes a defect in the escapement which none but a good workman can correct. Another fault with some watches—particularly with cheap ones—is, that the balance is too heavy for the power of the main-spring after the watch has gone for some time. The proper manner, and which I consider the only effectual means of remedying this defect, is to lighten the balance and put in a new spiral spring that will regulate the watch. Other means are frequently used, such as new main-springs, &c., but, after a time, they will again have the same defect, although frequently, if the main-spring is not properly tempered, it will set in the barrel and lose its power. In that case, the defect can be remedied by putting in a good new main-spring. I do not by this, advocate light balances for good time-keepers. For correctness, they must be as heavy as possible, so

that the balance can have a good motion; they regulate better, but all the other parts must be well proportioned and made on good principles. Some watches, even though uninfluenced by a change of temperature, are liable to variation from change of position.

There are some so favorably disposed to their watches as to describe them as keeping time within a minute for months, under all the circumstances of change of place, temperature, and irregular motion. They are excelled by others who say that their watches keep exact time with the sun, notwithstanding its well known irregularity.

Watches have been known to keep their rate for many months, even when subjected to jolting, hard riding, &c., but accuracy under such circumstances is accidental.

The extreme accuracy of marine chronometers is partly produced by their being constantly kept in a horizontal position. Their construction is the same as a pocket chronometer (except sometimes in the spiral spring), from which they differ but in size.

Marine chronometers are only required to show equal time; whether they gain or lose is of no consequence, provided they are regular and keep their rate.

Sir John Herschell has well said: "From the great perfection of the art, we have a right to expect wonders, but not miracles." If, therefore, a watch which measures time from the equal and undisturbed vibration of the balance, were to perform correctly under all the jerks and various motions to which it is liable when carried in the pocket, it would be more than wonderful. I have thus endeavored to fulfil, to the

best of my ability, the promise I made. Many accidents and unavoidable derangements may happen to a watch, which could not be explained here, without extending this essay far beyond its prescribed limits, and which can only be detected by a good and practical workman.

THE CLOCK—HOW TO USE IT.

A clock is a machine composed of wheels and pinions, to keep up the oscillations of a pendulum.

The wheels of a clock are made to revolve by means of a weight or a spring, called the maintaining power. This power must be sufficient to overcome the resistance of friction, to move the wheels, and to maintain the motion of the pendulum. The wheels of the clock are connected to the pendulum by pallets, which at the same time that they check the impetus of the wheels, receive their impulse to keep up the motion of the pendulum.

The escapement of a clock is that part by means of which the rotary motion of the escape wheel is made to produce an oscillating motion in the pendulum. Clocks are made with different kinds of escapements: the recoil or common pallets, the dead beat, and the free or detached. They are also made with the lever and pallets similar to watches, for clocks subjected to different motions, such as for ship's use, rail roads, &c.; but these last are never made with a pendulum, but with a balance. Ordinary clocks to which due attention

has been paid to the proper action, measure time more accurately than watches, the continuance of motion in the pendulum being better understood, and its irregularities more easily corrected than those of a balance. Long pendulums are preferable to short ones, for the greater the length, the slower the motion, therefore error is less in a long, than in a short pendulum. Heavy pendulums are the best, from being less under the variable influences of the impelling power, they are also less liable to be affected by external motion.

A light pendulum shows a clock badly constructed, or deficient in the power necessary for good performance. On selecting a clock, it should be observed whether the pendulum occupies the whole available length of the case, if not, it shows inattention to this advantage. The only exception to this rule are regulators and clocks which have the pendulums beating seconds, and measuring three feet three inches in length; this length is sufficient to insure accuracy. Although weight is preferable to spring as a maintaining power, yet fashion perhaps more than convenience has caused a greater demand for spring clocks. Those which require to be wound oftener than once a week, are apt to be forgotten; those going longer than a week, having a less marked time, are objectionable from the same cause. Clocks are frequently made to go only thirty hours, on account of cheapness, and will keep tolerably good time; but those going eight days, are to be much preferred, as in winding, it will frequently alter the time a trifle. Small clocks have short pendulums, and from their lightness, are liable to be stopped; they should therefore be made as heavy as convenient, and when

lead can be put into the case to add to its weight, there is less risk of it being moved accidentally. The additional weight also steadies the suspension, and produces more equal motion in the pendulum, but when the expense can be incurred, it is better to have small clocks made with a balance, as they can be moved without disarrangement. In moving a clock with a pendulum, be particular after you have placed it where you wish it to stay, to listen if the beats are regular; if not, you must make them so by either raising or lowering one side of the clock. Should it be a hanging clock, something should be put at the sides to keep it steady, and in its place, otherwise frequently in winding it, it may get disarranged from its beats, and stop. The heavier the pendulum is, the better is must be in beat. Clocks on brackets, or on feet for mantels, &c., can be put in beat by raising or lowering one side to make it beat regular. Clocks are regulated by lengthening the pendulum to make them lose, and by shortening it, to make them gain. This is done either by the insertion of a key to turn an arbor or square, which lengthens or shortens the pendulum, or by turning a nut for the same purpose. Nearly all fine French clocks have the pendulum hung on a fine spring; these mostly regulate by a square at the top of the dial; others have them hanging on a piece of silk, with one end fastened around a wire, which is turned either from the back of the clock by a knob at the end of the wire, around which the silk winds itself, or else by a square, to which a key is fitted in the front part of the clock. All clocks whether regulated from the back or front, are made to gain by turning the key or nut to the right, the way in

which the hands set forward, and the contrary to make it go slower. When the screw is under the weight of the pendulum, it is also turned in the same direction; but when the screw is above the weight, the rule is reversed. Do not move the hands of your clock back past the twelve, or you will disarrange the striking. To correct the striking, the hands can be moved rapidly forward until they are made to correspond with the hour struck; or the minute hand may be advanced to within two or three minutes of the hour, and then brought back sufficiently to allow the clock to strike, and is repeated until the hour struck is the same as shown by the hands, which should be set forward to show the proper time, suffering each intervening hour to be struck progressively. This applies to French clocks, and to most of the American ones; some however, are made with a small rod in the case under the dial, which by being either pushed or pulled, will make the clock strike; in this case, make it strike each hour separately, until you get it correct. But should the hours not strike regular in succession, then show it to some clock maker, for there is a defect which he can correct.

The hands of English clocks, "with few exceptions," may be turned either way without injury, the same as with a watch, except when having an alarum.

This is all that suggests itself to me as being useful to the public, except this caution; if there is anything that you do not understand when a clock is out of order it is better to apply to a clockmaker, than to attempt to correct it yourself, as by so doing, you make bad worse, and increase the cost of repairing.

A life like mine devoted to measuring the flight of

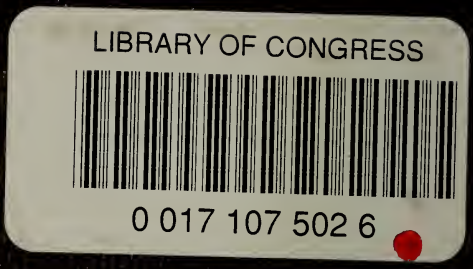
time, admonishes me that there is a *time* for all things; a *time* to begin and a *time* to end. I therefore conclude in the earnest hope that those who have attentively read my remarks, will not consider it time misspent, but feel that they have thereby added to their stock of useful knowledge. If I have accomplished this, I shall not repent that I for a *time* exchanged the work bench for the writing desk, and I shall return to the work-bench to continue as I have for so many years heretofore been, the public's most faithful and efficient servant, to make, examine, or repair it's watches; and when *run down*, hope to be *wound up by my Maker*, and set eternally going in the life to come.

And now my task being ended, I cast it on the waters, saying—

"Go thy ways;
And if, as I believe, thy vein be good,
The world will find thee after many days."

THE AUTHOR.

Nov. 3 1860.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